South-West Coast Scientific Group

Report on the proposed Southern Ocean Offshore Wind Farm

Common Myths Against Offshore Wind Farms

South-West Coast Scientific Group

The South-West Coast Scientific Group of the Clean Ocean Foundation comprises three retired academics, a Marine Biologist, a Medical Academic and a Physicist. We have a combined 50 years' experience in Marine Sciences and 35 years in evaluation of research for policy development.

We declare an interest as surfers, whale and bird watchers, and recreational fishermen. We have a strong interest in our marine environment and recognise the urgency of halting global warming.

Along with others, we made the case successfully to the Minister for Climate Change and Energy for the wind farm not to include the Bonney Upwelling, an area of unique ecological importance for all marine life, and especially for Blue Whales and seabirds.

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Cover Photo. The *Cape Petrel*.
Courtesy of BrettJarrett@bayofwhalesgallery.com

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Executive summary

The proposed offshore wind farm (OWF) will bring many benefits to the community, especially that of renewable energy. Chief among the myths against OWLs is that wind farms kill whales. They do not.

On balance wind farms are beneficial for all marine life because they create artificial reefs, leading to increased fish stocks, and provide a virtual marine park to protect those fish. Wind farms are much better for marine life than coal, oil or gas. They may also be good for whales and all other species because they contribute to controlling damage from global warming, such as the coral bleaching of the Great Barrier Reef.

A good review of wind farms is available from ABC News in Depth. *Are wind farms really a threat?*

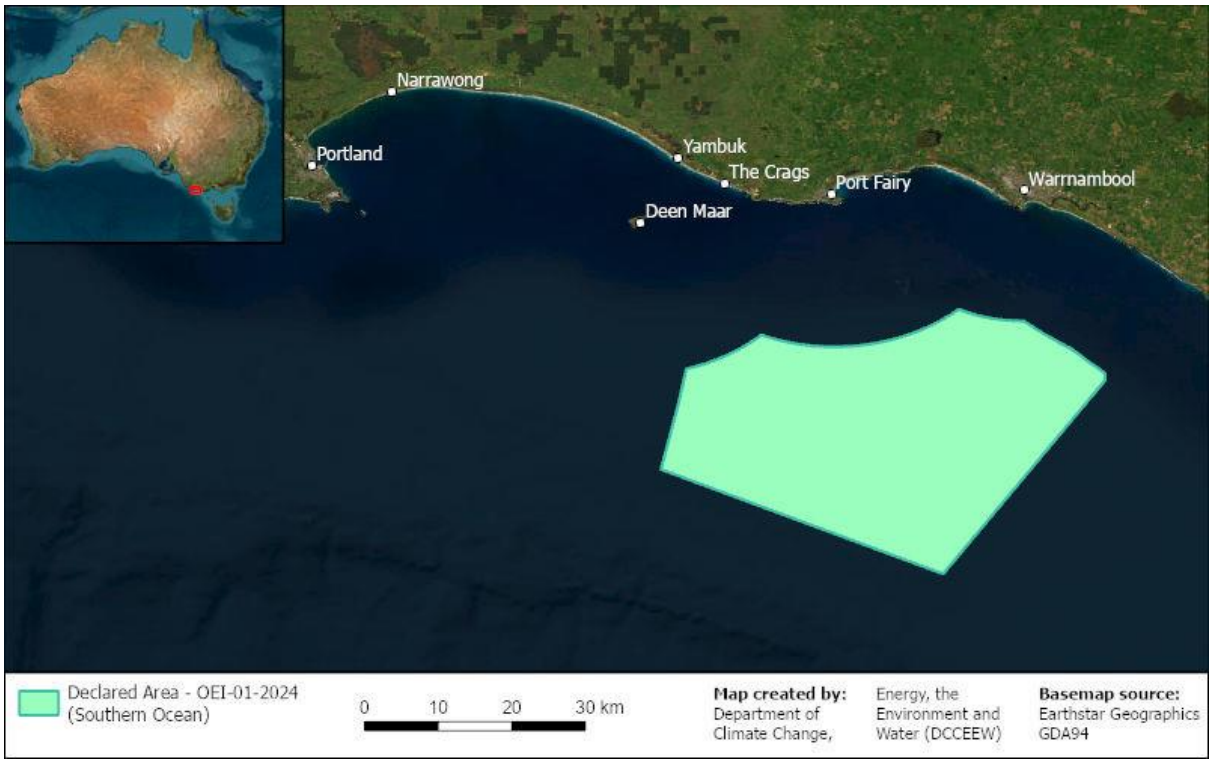
https://www.youtube.com/watch?v=H_dbh10orQc

Introduction

On 6th March 2024, the Minister for Climate Change and Energy, Minister Bowen, designated an area in the Southern Ocean off Victoria for an offshore wind farm (OWF). This followed a consultation in which 3,285 submissions were received including from South-West Coast Scientific Group which argued to keep the OWF clear of the main area of the Bonney Upwelling. The newly designated area will cover 1030 square kilometres (32 x32 km), potentially generating 2.9 gigawatts.

The Minister has said, 'I won't be revoking the zone.'[1]

The area designated for the offshore wind farm area by Minister Bowen.



There are strong reasons to site an Offshore Wind Farm off the Warrnambool coast:

- Offshore turbines can generate greater capacity than onshore in part because they can be larger.
- Strong, consistent winds, among the best off the Australian coast.
- Strong afternoon winds when demand is peaking.
- Proximity to areas of high electrical demand including the Portland Aluminium Smelter.
- New employment opportunities, including high end occupations.
- It is clear of the Bonney Upwelling and the Bass Strait.
- Commercial fishing areas and Portland's shipping lanes are avoided.

While all power generation has environmental costs,[2] a number of myths have arisen specifically against offshore wind farms.

This review has been undertaken in the light of Minister Bowen's decision to proceed with an offshore wind farm to address the myths against them.

A disturbing pattern has emerged in the climate.

If we are to limit the average atmospheric warming to below 2°C, and preferably below 1.5°C, scientists agree that we need to move much faster to halt climate change.[3]

Australia is particularly prone to the consequences of global warming. The climate is now hotter by an average of 1.1°C. Already we see species extinctions, record wildfires, record breaking temperatures, rising sea levels and extreme climate events, such as flooding in Queensland.

The oceans are near a tipping point. Polar ice is melting at an alarming rate, oceanic currents driven from Antarctica are weakening, and the sea is on average 3°C warmer and increasingly acidic.

The United Nations insists that deep, rapid and sustained emissions reductions are needed now. Based on the advice that he gets from the best scientists in the world, including Australians, UN Secretary General António Guterres has repeatedly spoken out with rare honesty about what needs to happen. "We are hurtling towards disaster, eyes wide open," he has warned.[4]

The Director of the International Energy Agency has said "Development of new oil and gas fields must stop this year if the world is to stay within safe limits of global warming and meet the goal of net zero emissions by 2050."[5]

The myths against OWFs.

Myth#1 Wind Farms kill Whales.

There is no evidence from anywhere in the world that suggests that wind farms kill whales. Independent assessment of the increased number of dead whales washed up on the beaches along the US eastern seaboard demonstrates that they were due to ship strikes, entanglement in fishing nets and warming oceans moving whales northwards. There are mitigation measures that can be taken to reduce ships colliding with whales. (See the mitigation section below.)

A study from Yale covers many aspects of whale strandings and deaths, stating that they have not actually become more common.[6] By contrast, seismic blasting for oil and gas exploration is known to be harmful to all marine life.[7-12]

In summary, wind farms do not kill whales.

Myth#2 The Whales won't come.

Southern Right Whales leave Antarctica where they feed on plankton and move up the West Coast of Tasmania across the Bass Strait and along our coast to the Great Australian Bight. There are several whale nurseries, including Logan's Beach, Warrnambool. The wind farm site is well clear of the corridor that they use. Studies of the Southern Rights off WA, South Africa, and South America strengthen this view.[13,14] It is unlikely that the wind farms will make any

difference to the Southern Right Whales.[15] (Personal Communication, Professor RD McCauley, March 2024.)

The changes to the OWF location announced by Minister Bowen mean that the area in the Bonney Upwelling that is largely used by the Pygmy Blue Whales will be free of the proposed wind farm. It is suggested that small numbers of whales may be displaced by the wind farm but that remains to be demonstrated. Certainly, there is currently no evidence from the North Sea that this will happen.

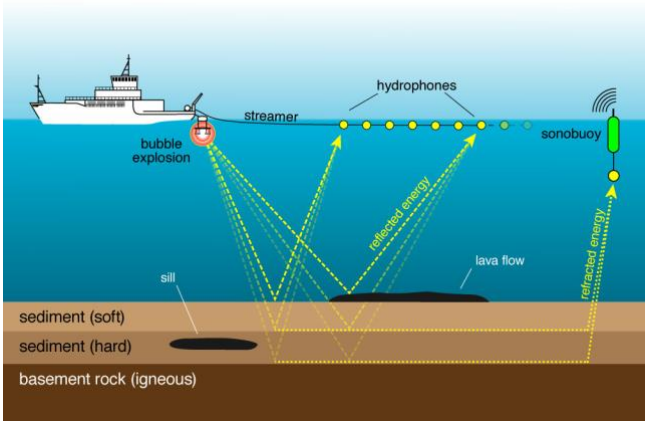
In summary, wind farms are unlikely to bother Southern Right Whales nor most megafauna.

Myth#3 The noise will drive whales away.

There is a world of difference between long-term seismic testing for oil and gas exploration and short-term sonar mapping for offshore wind farm construction.

It is seismic surveys for gas and oil exploration that will drive the whales away. These surveys use air guns that discharge bubble explosions which generate intense sound impulses of 250 dB every 10 seconds or so, all day long (except when the survey ship is reversing course) for up to 200 days. Such seismic blasts are needed for the sound to penetrate several kilometres into the seabed to locate the strata containing the oil and gas.

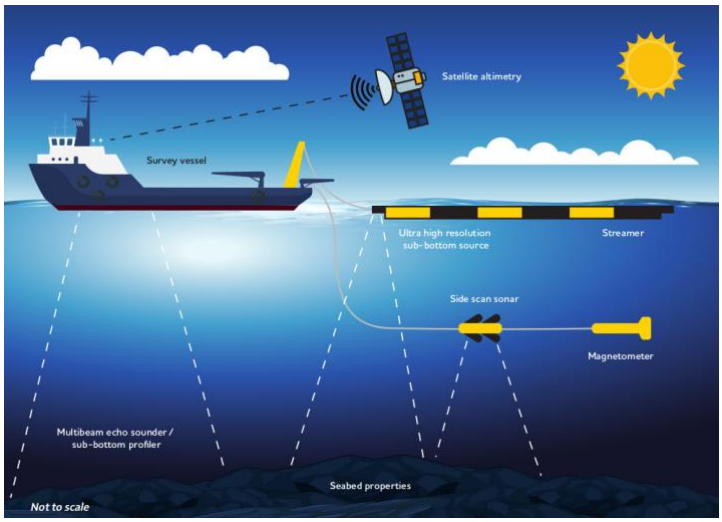
Apart from effectively sterilising the Operational Area by killing all krill, the keystone species, these discharges overwhelm the **low-frequency** sounds to which baleen whales are most sensitive and which they use over very long distances.



Schematic illustrating seismic surveys for oil and gas.

Geophysical surveys for locating offshore wind turbines also use sound waves, but only to collect data on conditions at the seafloor and in a shallow subsurface layer. The latter is just 50-100 metres thick as turbines are typically installed around 50 m in the seabed. Such surveys are a very low energy, low impact activity that occurs over a short time. High-frequency sonar used to map the seafloor is harder for whales to hear and has been shown not to harm them beyond behavioural disturbances. Additionally, these high frequency pulses are absorbed more rapidly through the water column than are low-frequency sound. A whale would need to be close to the

ship for the noise to matter but this exposure is unlikely as the ships carry marine observers to warn of the presence of whales.



Fact Sheet November 2023: Geophysical investigations for offshore renewables, Offshore Infrastructure Regulator. (https://www.oir.gov.au/sites/default/files/Fact%20sheet%20-%20Geophysical%20investigations%20for%20offshore%20wind%20-%20November%202023.pdf)

Geo-technical investigations are also used. These involve collecting shallow core samples of seabed sediment to understand its composition and strength.

Therefore, only during the construction phase do wind farms generate significant noise.

Thomsen et al.[16] report that there may be some disruption to the marine animals during the construction phase, but these effects can be mitigated by using "bubble curtains", for example (see below). Of course, these effects are significantly less damaging than those caused by the intense acoustic pulses during seismic surveys for oil and gas.

Bubble curtains around the OWF construction site can dampen sound reducing its effect on the surrounding ecosystem. Such curtains are in use in the North Sea.

Bubble curtain used during construction.

During operation, OWFs generate low frequency noise (less than 100 Hertz) due to the vibrations of the tower that is transmitted down the pile leg to the seabed, during which much of the signal is lost. The low-frequency sound does not propagate well and the result is poor

transmission of noise horizontally, with an impact range limited to a few hundred metres. The noise is relatively benign for animals, unlike the intense acoustic pulses from the air gun blasts used in seismic surveys. The OWF sound amplitude will be comparatively low, sounding more like a low frequency rumble.

In summary, wind farm noise is unlikely to bother baleen whales or most megafauna during operation.[15]

Myth#4 It will damage fishing.

Nothing could be further from the truth. The offshore wind farm creates an artificial reef and the restricted access to them creates refuges in which marine life can flourish. The wind farm jackets and their surrounding rock piles will be rapidly colonised by many species up to the big pelagic fish.[17,18] This has already occurred in the North Sea, generating a new tourist industry. For example, people take trips from the Norfolk coast to see the seals and other wildlife that are much richer since the wild farms were established. By contrast, seismic blasting for oil and gas exploration destroys krill, the keystone species and underlying food source, and fish.[7-12]

The limited access to the area around the wind turbines creates a marine refuge in which fish availability and fishing locally will improve.

Myth#5 It will damage the Eel population.

No, it will not. When the eels leave the river mouths, they swim well within 10km of the shore, well away from the wind farm. Furthermore, there is nothing about wind farms that would harm eels anyway, even if they were close to them. By contrast, the intense noise generated during seismic testing is harmful to eels.

The eel population will be unaffected. On the contrary, fishing may improve outside the designated OWF area in which fish will breed.

Myth#6 The wind farm will be so unsightly that no one will want to come to Logan's Beach whale viewing platform or Port Fairy.

A UK study of the visibility of OWFs assesses that turbine blade movement and night-time navigational lighting are visible at 39km. However, their visibility dropped off to 16km or less when cloud cover was present. Part of the reason for the visibility of the turbine towers was that it was deliberately enhanced. The bases of turbine towers were painted yellow to be easily seen for marine safety reasons.[19]

In the case of the proposed wind farm, most of the turbines will be up to 50km offshore and so invisible over the horizon. The nearest turbines of the wind farm will be 15km from Logan's Beach, Warrnambool, and 20km from Port Fairy. (Note that the horizon observed from a height of 20 metres is only 15 kilometres away.) They may be visible during the day, and at night, their navigation lights may be visible. The turbines will be 1-2km apart.

In summary, the wind farms may be visible but only on the horizon.

Myth7 Wind farms cause ill health.

Wind farms have been around for hundreds of years, such as the Dutch windmills. There is no evidence over that long period of time that offshore wind farms damage human health.

Myth8 There will be catastrophic numbers of bird deaths.

It is true that birds are killed within warm farms, but far less so than by onshore skyscrapers and telegraph wires. In general, birds will fly around wind turbines, although some will fly into the blades, especially if visibility is poor in bad weather.

The region proposed for the wind farm contains vulnerable and endangered species, some covered by treaties. The general area is a feeding ground for 60 species of oceanic birds, 14 of them albatross, including the Shy Albatross, which breeds on three remote islands off Tasmania (Brett Jarrett. Personal communication, 18th August 2023).

We can only locate one Australian study of onshore wind farm bird collisions and no offshore studies. Almost all studies were done in the UK, Belgium, Germany, Netherlands, Portugal, Spain and the USA. Our analysis is based on careful imputation, species by species.

It is difficult enough to determine the mortality rate on land but it is far more difficult at sea. Collision rates are estimated as relatively low at 0.01-23 birds per turbine per year but with wide variation between species. Studies indicate that high buildings and power lines result in greater numbers of deaths than OWFs.

The Little Penguins will benefit because they hunt underwater and move underwater between places like Middle Island and what will become a much richer food source around the wind farms.

The Australian Gannets around Portland are largely out of the way of the wind farms although a few do fly in that area.

We can be categorical in dismissing myths #1-7 and #9. The scientific complexity of reporting on the effects of OWFs on seabirds is why we have written more detail in the Appendix.

In summary, the risks to seabirds from offshore wind farms in general and the proposed one in particular are not fully known. However, the collision rates are estimated to be small.

The Little Penguins, which feed underwater, may benefit from the increased marine life on the artificial reef around each wind turbine pylon. Other seabirds may also benefit from the enhanced food stocks, leading to population increases. Higher numbers of casualties are expected but will be outweighed by the population increase.

Bird surveys should be conducted as part of the Environmental Impact Assessment for the OWF.

Myth#9 Damage to marine life from electromagnetic fields

Electromagnetic fields from power cables have been raised as an issue. They are unlikely to bother whales just as the plethora of power lines snaking across the landscape, both at low- and

very-high-voltage, do not bother humans. As the electric field drops away by the 3rd power of range, the field will be much weaker at the surface, where the whales swim, than at the bottom, where the cables will lie. It is possible that the fields might impact skates, rays, and bottom feeding sharks, which have good electromagnetic sensors. More research will be needed.

The whales will still come!!

Planning Mitigation of Adverse Effects of Offshore Wind Farms

There are some aspects of OWFs where choices can be made to minimise their downside. There is an opportunity to participate in the next round of community consultation from July.

Increased shipping traffic and associated noise

Sea traffic to the wind farm can be reduced by having crews on rotation and staying offshore. Vessel design and operational awareness, including teaching Masters how to keep the noise levels of vessels down, will be important. These should be incorporated into the various tickets they are required to hold, such as those taught by TAFEs.

Use best practice construction methods.

It will be important to examine the most up-to-date evidence on construction methods. The natural tendency of industry to take the cheapest option and government to accept the cheapest bid will need to be countered by community pressure.

During the construction phase, use can be made of previous 2D and 3D surveys and pile driving noise can be mitigated by carrying out pile driving when species of concern are absent. The use of bubble curtains, which absorb sound energy from immediately around the pile, could be a condition for approval.

Sea Birds

Before the wind farm is constructed, the community should insist on bird surveys with a view to determining the best forms of harm mitigation. (See Appendix I Sea Birds and Offshore Wind Farms.)

Objective 2 of Australian Government Wildlife Conservation Plan for Seabirds lists, as a very high priority, identifying important habitats and the need to mitigate threats from renewable energy. EPBC Act amendments are to be completed by 2030. Objective 2 states that by 2023 a comprehensive sensitivity analysis should be published to mitigate threats from renewable energy.

What can the community do?

Although offshore wind farms are relatively new in Australia, they account for very large proportions of the energy production in the European Union, the United Kingdom and the United States. Each has a regulatory agency with long experience of seeking good outcomes for all parties. The other benefits through increased job opportunities need to be explored.

It would be in the interest of local government, NGOs and others to investigate what has already been implemented elsewhere in the world. Perhaps a ***joint task force*** could be set up? It could include Moyne Shire and Warrnambool City Councils, NGOs like Birdlife Australia, Australian Marine Conservation Society, Surf Riders, fishermen's organisations, and community members.

Establish a joint task force to identify best practice.

Applications for feasibility licences will open at the beginning of July. During the feasibility stage, developers must undertake detailed Environmental Impact Assessments and commence consultations to explain how the project will coexist with shipping, tourism and fishing industries. This is the opportunity for the community to get the best from this opportunity through:

- **Advocating for economic benefits from the wind farm**
- **Advocating that the building techniques are the least damaging to the environment and undertaken at times of the year when it will be safest for marine life.**
- **Demanding that bird surveys should be done in the area before any building starts and the plan for the successful company should include aspects of bird safety long term. (See Appendix)**
- **Insisting that shipping is kept to a minimum and that Masters are required to operate the vessels in the safest manner for the marine environment.**

Joint task force to prepare the written case and to coordinate lobbying.

Conclusion

A logical position is:

- to support the move to renewable energy generated by wind farms,
- to oppose seismic blasting, which causes significant damage to the ecosystem, and, consequently,
- to oppose any further exploration by oil and gas companies.

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Appendix

Summary

There are many threats to seabirds. Climate change is a high risk and renewable energy is a solution.

The area chosen for the offshore wind farm (OWF) is a small part of the plankton-rich area of the Bonney Upwelling and clear of the Bass Strait migratory routes.

The risk to seabirds from offshore wind farms in general and the proposed one in particular are not fully known. There have been few Australian peer-reviewed studies of onshore wind farms. There has been a consultants' report for the Australian Government Department of Climate Change, Environment, Energy and Water (DCCEEW).

Some species of bird are collision prone, some show ability to detect and avoid moving turbine blades and some may be displaced from their habitat. The abundance of a bird species is a poor predictor of collision rates.

The Little Penguins, which feed underwater, and many surface feeding birds may benefit from the increased marine life on the artificial reef around each wind turbine pylon. The increased food may lead to increases in population numbers in excess of losses due to collisions.

Bird death as a by-catch of commercial fishing would not occur within the OWF area.

Bird surveys should be conducted as part of the Environmental Impact Assessment for the OWF.

What do we know about wind farms and birds.

What protection exists already?

Birdlife Australia recognises that global warming will impact negatively on bird conservation. Its *Wind Farms and Birds Policy* recognises that we have inadequate knowledge about the impacts and recommends measures which are included below under the heading of mitigation.[1]

Detailed sources [2,3] of vulnerable and endangered birds in the Southern Ocean off our coast include Cornell University's database called eBird, which is a compilation of citizen scientist birdwatchers' records. For recent data on seasonal presence and relative abundance of seabirds around the Operational Area, the following link is relevant: Port Fairy Pelagic, Lady Julia Percy Island, VIC, AU - eBird Hotspot

Most bird species are categorised as threatened or endangered. The plankton-rich area of the Southern Ocean is an important feeding area as maps in the Seabird Atlas show, as well as the density of plankton shown in the images of chlorophyll a[4] (Fig1)

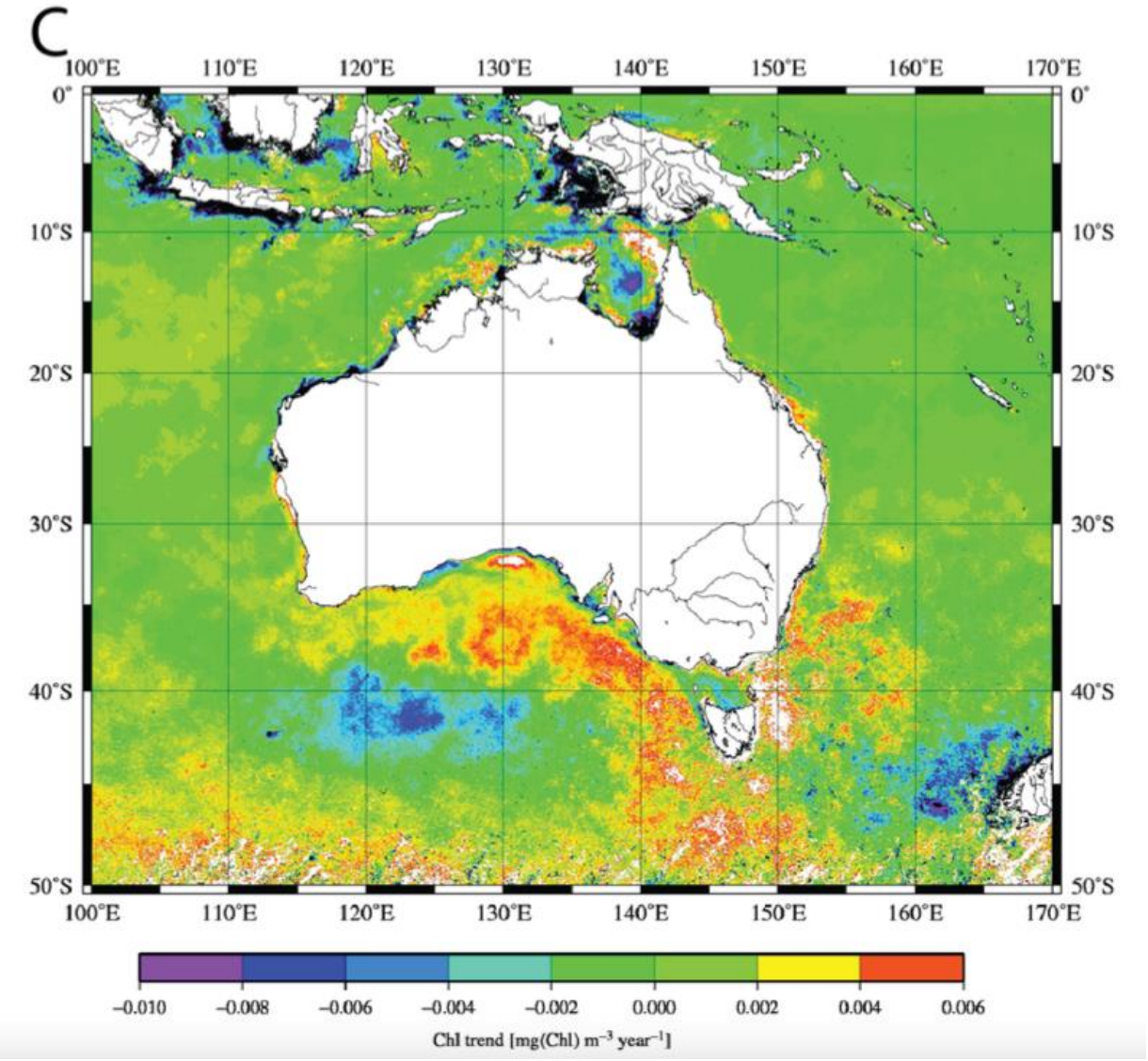

Figure 1. Chlorophyll a in the Australasian region between 2003 and 2019. High chlorophyll a concentration is shown in red.

Seabirds highlight the interdependence in the ecosystem, starting with krill, the keystone species. Some seabirds, such as shearwaters and petrels, prey directly on krill. Others, such as gannets, terns and albatross, as well as tuna, prey on bait fish that may in turn have fed on krill.

Some measure of the importance of the local area of the Southern Ocean both for local birds, such as the Sooty Shearwaters breeding on Griffith Island, Port Fairy, and the more-distant ones can be inferred from the presence of the Campbell Island Albatross. It only breeds on the Campbell Island group, New Zealand's furthest south sub-Antarctic Island, at 52.54°S, 169.14°E.

At the national level, the *Environment Protection and Biodiversity Act 1999* (EPBC Act) provides for the development and implementation of wildlife conservation plans. The Australian Government

Department of Agriculture, Water and the Environment (now DCCEEW), in consultation with interested stakeholders, has developed a Wildlife Conservation Plan for Seabirds.[5] The Act applies to the planning for the OWF.

The wildlife conservation plan sets out the research and management actions necessary to support survival of one or more migratory, marine, conservation-dependant or cetacean species listed under the EPBC Act, which are not considered endangered or vulnerable, but would benefit from a nationally coordinated approach to their conservation.

Australia has statutory obligations to conserve EPBC Act-listed seabird species within its jurisdiction and internationally through agreements, such as the Convention on Migratory Species (CMS), the Agreement of the Conservation of Albatross and Petrels (ACAP) and the bilateral migratory bird agreements.

The plan lists climate change and its consequences of warming seas, storms and cyclones along with bird by-catch from fishing as ***almost certain*** risks to seabirds. Shipping, pollution and OWFs are lower risks ranked as ***possible*** (Table 3 of the report).

The report states that:

"The potential effects of OWFs on seabirds are not yet fully understood. Seabirds may be directly affected through collision with infrastructure or indirectly affected by displacement from foraging areas. A key question is how MREDs (OWFs) may affect seabird foraging success through changes in foraging behaviour and will be key to understanding whether large-scale installations could have impacts at a population level.

A key research area needed to address this issue is to better understand seabird distribution and foraging behaviour. This information will improve our understanding and be able to better predict adverse impacts in seabird populations.[5]"

A report for DCCEEW lists the birds that may be present, assesses their risk in terms of conservation status, generation time, distribution and feeding habits, and morphology but does not attempt to estimate likely casualties, It does cover the importance of bird surveys and approaches to mitigation.[6] Annex A contains the report's list of species with the highest risk scores.

What do we know from research?

Almost all reports of the effect of OWFs on seabirds come from the Northern Hemisphere. Few species overlap with those off the coast here. Assessing the impact on birds from collisions, habitat loss and displacement is difficult enough on land. Collecting information on the movements of birds at sea is significantly more difficult. Most studies put the losses as relatively low.[7,8,9] Knowledge of birds in the area of the proposed OWF is essential. This lack of data needs corrected by surveys before approval is given for construction.

The great bulk of studies have been conducted in western Europe on terrestrial wind farms with most studies of OWFs in the Atlantic and the North Sea.[7-12] With caution, we can impute from these studies but casualty rates and habitat loss are highly species dependent.

More than one study of OWFs states that no impact on birds have been recorded and that the majority of studies of collisions have recorded relatively low levels of mortality.[7-13] Even these levels of mortality could be significant in long-lived species or species listed as endangered. Collision risk

depends on a range of factors including bird species, numbers and behaviour, weather, and the nature of the OWF itself, and its lighting.[6-14]

Another study of onshore wind farms from the USA comparing the impact on birds from wind turbines and shale oil wells showed that shale oil wells reduced the bird population by 15% but the wind turbines had no impact.[13]

This study of onshore causes of bird deaths in the United States estimated the following numbers of bird mortalities:

• Vehicles: 60 million - 80 million
• Buildings and Windows: 98 million - 980 million
• Powerlines: tens of thousands - 174 million
• Communication Towers: 4 million - 50 million

By contrast, wind generation facilities accounted for 10,000 – 40,000.

Collision rates are estimated at 0.01 to 23 birds annually. There are some places with high collision rates because the onshore wind farms were sited badly. They include Altamount Pass USA, Tarifa Spain and Smola Norway.[11]

The distance birds leave between their flight paths and turbines is species dependent. Studies suggest it varies between 100-700m. Some birds will fly between turbine rows.[11,14]

For example, many birds cross the Straits of Gibraltar near Tarifa, Spain, on migration between Africa and Europe. It is the shortest route with the best conditions for soaring and gliding. The windfarms did not result in many deaths but merely a displacement in their flight paths of on average 674m to the side of wind farms.[11] The key point is that birds change their flight paths to avoid wind farms.

We have only located one original Australian study of collisions at onshore windfarms in Tasmania.[15] The authors have reported collisions by seabirds, including diving-petrels, shearwaters, prions, storm-petrels and gannets. Species with large wingspans and relatively slow wing beats (high wing loading) are known to be susceptible to striking terrestrial windfarms, suggesting albatrosses and larger petrels may be at risk if offshore windfarms are constructed, though choice of blade height can mitigate collisions.

In this onshore Tasmanian study, the number of species detected from carcass surveys was substantially less than that detected during utilisation surveys. This indicates relatively low casualty rates. Presence and abundance on site were poor predictors of collision risk. Specific factors were associated with which birds collided with turbines. For instance, among nine Raptor species present, only four were involved in collisions.

The key features that make some birds more prone to collision maybe:

- morphological, relating to their ability to detect moving turbine blades,
- their agility, the ability to avoid a blade once detected,
- ecological, relating to the food and where and how they obtain it, and
- behavioural, how they move through the site and avoid turbines.

The additional risk of nocturnal flights for species, such as short-tailed shearwaters, is included in this behavioural feature. Birds have been found to actively avoid wind turbines, described as species avoidance rate.[15]

Mitigation

The requirement for an Environmental Impact Assessment.

Applicants to build the windfarm will be required to conduct an Environmental Impact Assessment.

Site of the wind farm.

- As the site of this wind farm is more than 10km offshore, it is well away from breeding colonies that might be affected by it. Waterfowl and waders are unlikely to be that far offshore to be near to the wind farm.
- The distance between turbines is said to be 1 to 2km, allowing birds to fly between them. Based on available data, a 2km separation is preferable.
- There is a large habitat area, rich in feeding to the west – the Bonney Upwelling. As Fig 1 shows, the proposed area for the wind farm is well away from most of this plankton rich area of the coast.
- There are no migratory flightpaths through the OWF. The site is to the west of the Bass Strait migration path for Orange Bellied and Swift Parrots
- Bird losses may well be more than offset by the increased population benefiting from food from the artificial reef around the wind towers.
- Little Penguins remain largely underwater when they feed. They will be likely to benefit from the increased food sources resulting from the artificial reef around each wind turbine.

Make rotor blades more visible to birds.

- Research continues into high contrast patterns, such as square-wave black and white bands across the blade and UV paint, because they have a high potential to reduce collisions.
- Minimise lights at night.
- Only the turbines on the edge of the farm to have flashing lights.

Timing construction to avoid sensitive periods.

The construction phase should be undertaken outside of sensitive periods, such as when the Pygmy Blue Whales are feeding.

Dedicated research monitoring and evaluation.

Implementing an agreed post development monitoring period.
Pre-construction and post construction bird surveys. A Before-After-Control-Impact study design is preferred.

Pre-construction, an estimate of birds flying at blade height can be made and vulnerability of the bird population assessed. That said, the relationship between turbine height and bird collision rate is not consistent among studies. This suggests that, like bird abundance, the relationship between turbine height and collision risk may be site or species dependent, or both.

A bird survey can give information on:

- Bird species and prevalence
- Flight Height
- Flight Manoeuvrability
- Habitat Specialisation.

The number of birds with high wing loads and therefore soaring with poor manoeuvrability, such as albatross, can be assessed.[7,10,12,14,15]

A recent review of studies of ship-based and aerial surveys for wind farms concluded that the use of the two methods is complementary, with each fulfilling different objectives. An aerial survey provides simultaneous coverage of extensive, offshore areas and reliable 'snapshot' information on distribution and numbers. A ship-based survey is better for detailed observations of behaviour, perhaps in relation to oceanographic data collected at the same time, for determining age and sex of birds, and for discriminating between similar species.[16]

Technological solutions that are in use in the northern hemisphere, including radar, LiDAR (light detection and ranging) and blade-borne devices with cameras and microphones, are available to map bird distribution and activity around, and collisions with, offshore windfarms. Combining different approaches to maximise the available data to address seabird risks will deliver more effective mitigation consistent with expansion in offshore windfarm infrastructure.[6]

This Appendix gives a summary of the requirements for wind farm Environmental Impact Assessments. Although methodologies are still, to a large extent, under development, more detailed guidance on current approaches and recommendations is available from official UK and EU sources, as well as the DCCEEW report.[6,14-17]

Repowering

When turbines are being upgraded or replaced, the latest knowledge on bird conservation should be applied.

Conclusion

Offshore wind farms do kill birds but the numbers are probably not all that high and vary between species. Birds fly through wind farms and may benefit from increased fish stocks due to the artificial reefs that the wind towers create.

Before and after construction bird surveys should be conducted.

Effective mitigation measures are being developed and techniques are evolving. The regulator should require that the most up-to-date measures to protect birds and any other vulnerable species are implemented.

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Annex A

In offshore regions in southern Australia the highest risk species were all albatrosses, including:

Northern Royal Albatross *Diomedea sanfordi*

Eastern Antipodean Albatross *D. antipodensis antipodensis*

Grey-headed Albatross *Thalassarche chrysostoma*

Gibson's Albatross *D. antipodensis gibsoni*

Wandering Albatross *D. exulans*

Campbell Albatross *T. impavida*

Amsterdam Albatross *D. amsterdamensi*

Indian Yellow-nosed Albatross *T. carteri*

Shy Albatross *T. cauta.*

Source

Reid, K, Baker, GB, Woehler, E (2022), Impacts on birds from Offshore Wind Farms in Australia, Department of Climate Change, Energy, the Environment and Water, Canberra. https://www.dcceew.gov.au/environment/epbc/publications